REFRIGERATOR-OVEN

CROSS-REFERENCE TO RELATED APPLICATIONS

This is a continuation-in-part of Application No. 10/716,914 filed on November 19, 2003.

BACKGROUND OF THE INVENTION

The present invention is directed to a combination appliance for cooling/freezing and cooking a food item, and more specifically to a self-contained refrigerator/freezer and oven, for refrigerating/freezing and cooking food in the same enclosed chamber, which can be actuated by the operator from a variety of remote locations around the world through a public exchange computer communications system, the public switched telephone network or the Internet.

Many families today have two wage earners and as a consequence, there can be a significant delay when they both return from work before the evening meal can be prepared. Not only that, but sometimes their schedules change during the day so that the time when the evening meal is to be prepared must be changed.

There are a number of combination refrigeration systems and heating units known wherein the food is confined to the same space. U.S. Patent No. 6,121,593, Mansbery et al., the contents of which are hereby incorporated by reference, is directed to a food heating and cooling unit which may be actuated from a remote location. However, U.S. Patent No. 6,121,593 describes a combination appliance wherein the refrigerator is a thermoelectric heat pump and the oven is a microwave oven.

Conventional ovens, either gas or electric, offer the advantage of more traditional cooking processes which allow browning of a product and avoid the problems of accelerated and uneven cooking of some products (breads and chesses for instance) that arise with microwave cooking. Because the volume of the typical conventional oven is considerably larger than that of a microwave oven, a higher capacity cooling system is required than for the combination appliance with a microwave heating unit.

Thus the need exists for a combination refrigerator/freezer oven with a conventional oven and a cooling system with sufficient capacity to handle the cooling requirements of a conventional oven. Furthermore the need exists for a means for remote activation of the heating and cooling units.

BRIEF SUMMARY OF THE INVENTION

In view of the aforementioned needs, the invention contemplates a combination refrigerator/freezer and oven that provides for selective cooling and cooking of foods. The present invention further contemplates the combination refrigerator and oven is capable of actuation from a remote location. For ease of reference, the preferred embodiment of a refrigeration module will be discussed. However, it is understood that the invention is suitably comprised of a combination freezer and oven that provides selective freezing, thawing and cooking.

One aspect of the present invention contemplates a combination appliance for cooling and cooking a food item, comprising a frame, a door, a heat element, an inlet duct, a return duct, and a refrigeration module. The frame comprises a cooking chamber and a refrigeration module chamber, and the cooking chamber having an opening through which access to the interior of the cooking chamber is provided. The door moveably mounted to the frame for movement between an open position where the opening is uncovered and a closed position where the opening is covered. The heat element is disposed within the cooking chamber to selectively provide heat to the cooking chamber. The inlet duct extends between the refrigeration module chamber and the cooking chamber, and has an inlet in communication with the refrigeration module chamber and an outlet in communication with the cooking chamber. The return duct extends between the refrigeration module chamber and the cooking chamber, the return duct has an inlet in communication with the cooking chamber and an outlet in communication with the refrigeration module chamber. The refrigeration module comprises a compressor, condenser, evaporator, and base. The compressor, condenser, and

evaporator are mounted on the base to form a module. An insulated housing covers the evaporator to thermally isolate the evaporator from the condenser. The insulated housing has an inlet and an outlet, which align with the outlet of the return duct and the inlet of the inlet duct, respectively, when the refrigeration module is mounted within the refrigeration module chamber, to thereby form a refrigerated air path between the evaporator and the cooking chamber.

When remote actuation is desired, the present invention contemplates a first means for controlling the operation of the heating element and the refrigeration module, and a second means for sending and receiving data concerning the heating element and the refrigeration module to and from the remote location via either a telephone or the Internet, whereby an individual may evaluate data concerning the heating element and the refrigeration module received through the second means thus enabling the individual to direct and control the first means through the second means.

Another aspect of the present invention contemplates a combination appliance for freezing and cooking a food item, comprising a frame, a door, a heat element, an inlet duct, a return duct, and a refrigeration module. The frame comprises a cooking chamber and a freezer module chamber, and the cooking chamber having an opening through which access to the interior of the cooking chamber is provided. The door moveably mounted to the frame for movement between an open position where the opening is uncovered and a closed position where the opening is covered. The heat element is disposed within the cooking chamber to selectively provide heat to the cooking chamber. The inlet duct extends between the freezer module chamber and the cooking chamber, and has an inlet in communication with the freezer module chamber and an outlet in communication with the cooking chamber. The return duct extends between the freezer module chamber and the cooking chamber, the return duct has an inlet in communication with the cooking chamber and an outlet in communication with the refrigeration module chamber. The freezer module comprises a compressor, condenser, evaporator, and base. The compressor, condenser, and evaporator are mounted on the base to form a module. An insulated housing covers the evaporator to thermally isolate the

evaporator from the condenser. The insulated housing has an inlet and an outlet, which align with the outlet of the return duct and the inlet of the inlet duct, respectively, when the freezing module is mounted within the refrigeration module chamber, to thereby form a refrigerated air path between the evaporator and the cooking chamber.

When remote actuation is desired, the present invention contemplates a first means for controlling the operation of the heating element and the freezer module, and a second means for sending and receiving data concerning the heating element and the freezer module to and from the remote location via either a telephone or the Internet, whereby an individual may evaluate data concerning the heating element and the freezer module received through the second means thus enabling the individual to direct and control the first means through the second means.

Another aspect of the present invention contemplates a time-bake cooking cycle for a refrigerated oven used to cook a food item. The refrigerated oven comprises a cooking chamber selectively closeable by a door, a heating element for heating the cooking chamber, a refrigeration unit for cooling the cooking chamber, a temperature sensor for sensing the temperature of the cooking chamber, a data input device for inputting user-selected cooking cycle parameters, and a controller. The controller operably coupling the heating element, refrigeration unit, temperature sensor, and the data input device to selectively actuate the heating element and the refrigeration unit in response to the sensed temperature and to implement the cooking cycle as defined by the cooking cycle parameters. The time-bake cooking cycle comprising a cool cycle and a bake cycle. In an alternate embodiment, the time-bake cooking cycle further comprises a warm cycle. During the cool cycle the temperature of the cooking chamber is maintained at a first predetermined temperature to prevent spoilage of the food item in the cooking chamber. The bake cycle following the cool cycle maintains the temperature of the cooking chamber at a temperature to cook the food item in the cooking chamber. The warm cycle is suitably configured to follow the bake cycle to maintain the temperature of the cooking chamber at a temperature suitable for serving the food item upon removal from the cooking chamber.

The time-bake cooking cycle may further comprise a second cool cycle initiated after one of the cook cycle or the warm cycle. The time-bake cooking cycle would typically include a data input cycle prior to the cool cycle wherein user-defined operating parameters are stored in the controller. The user-defined operating parameters comprise an End Time representing the time of day that the cooking of the food is to be completed and a Bake Time representing the length of time to cook the food.

Yet, another aspect of the present invention contemplates a time-bake cooking cycle for a freezer oven used to cook a food item. The freezer oven comprises a cooking chamber selectively closeable by a door, a heating element for heating the cooking chamber, a freezer unit for cooling the cooking chamber, a temperature sensor for sensing the temperature of the cooking chamber, a data input device for inputting user-selected cooking cycle parameters, and a controller. The controller operably coupling the heating element, freezer unit, temperature sensor, and the data input device to selectively actuate the heating element and the freezer unit in response to the sensed temperature and to implement the cooking cycle as defined by the cooking cycle parameters. The time-bake cooking cycle comprising a freeze cycle, a bake cycle, and a warm cycle. In an alternate embodiment, the time-bake cooking cycle comprises a freeze cycle, a bake cycle, and a warm cycle or cool cycle, or both. During the freeze cycle the temperature of the cooking chamber is maintained at a first predetermined temperature to prevent spoilage of the food item in the cooking chamber. The bake cycle following the freeze cycle maintains the temperature of the cooking chamber at a temperature to cook the food item in the cooking chamber. The warm cycle following the bake cycle maintains the temperature of the cooking chamber at a temperature suitable for serving the food item upon removal from the cooking chamber.

In another embodiment, the time-bake cooking cycle comprises a cool cycle initiated following the completion of one of the cook cycle or the warm cycle. The time-bake cooking cycle would typically include a data input cycle prior to the freeze cycle wherein user-defined operating parameters are stored in the controller. The user-defined operating parameters comprise an End Time representing the time of day that the cooking of the food is to be

completed and a Bake Time representing the length of time to cook the food.

Still other aspects and advantages of the present invention will become readily apparent to those skilled in this art from the following description wherein there is shown and described a preferred embodiment of this invention, simply by way of illustration of one of the best modes best suited for to carry out the invention. As it will be realized, the invention is capable of other different embodiments and its several details are capable of modifications in various obvious aspects all without departing from the invention. Accordingly, the drawing and descriptions will be regarded as illustrative in nature and not as restrictive.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

The accompanying drawings incorporated in and forming a part of the specification, illustrates several aspects of the present invention, and together with the description serve to explain the principles of the invention. In the drawings:

FIG. 1 is a functional block diagram of combination cooling/freezing and cooking system for food, which may be actuated from a remote location;

FIG. 2 is a block diagram overview of the software included in the present invention;

FIG. 3 is a flow chart describing the initialization of the home appliances for remote access;

FIG. 4 is a flow chart describing the remotely located software used to communicate with the home appliances from a remote location;

FIG. 5 is a flow chart illustrating the selection of a particular home appliance for remote operation;

FIG. 6 is a flow chart describing management of the home appliances, which includes determining which home appliances will be available for possible remote access;

FIG. 7 is a flow chart illustrating the determination of food dishes that will be available for preparation in the home appliances from a remote location;

FIG. 8 is a flow chart describing how the home appliances operation buttons are accessed from a remote location;

FIG. 9 is a flow chart illustrating how a food dish is programmed for preparation in a home appliance from a remote location;

FIG. 10 is a flow chart describing the process for reproducing the information displayed by home appliance at a remote location;

FIG. 11 is an isometric view of a combination appliance;

FIG. 12 is a perspective view of a combination refrigerating and cooking system with a drawer containing the refrigeration module in the open position;

FIG. 13 is a perspective view of a combination refrigerating and cooking system with a door providing access to the cooking chamber in the open position;

FIG. 14 is a block diagram of the components of the refrigeration module; and

FIG. 15 is a perspective view of a gate assembly of a combination appliance.

DETAILED DESCRIPTION OF INVENTION

Throughout this description, the preferred embodiment and examples shown should be considered as exemplars, rather than limitations, of the present invention. For ease of reference, the preferred embodiment of a refrigeration module will be discussed. However, it is understood that the invention is suitably comprised of a combination refrigerator/freezer and oven that provides selective refrigerating, freezing, thawing and cooking.

Referring now to FIG. 1, the cooking and refrigeration chamber is indicated at 10 in dotted outline. Contained within the chamber is a refrigeration module 11 that is utilized for cooling the cavity 17. Temperature control 14 is used to turn the refrigeration module 11 on and off. Temperature sensor 15 is used by temperature control 14 to maintain a desired temperature.

The heat element 18 as shown is connected to the control relays 19. Ordinarily, the heat element 18 may either be an electric resistive element or a gas burner, however other types of heat elements such as microwave, radiated heat elements, infra red, or any other heat source may also be utilized. As shown the heat element is controlled by control relays 19. Temperature control 14 can be used to activate and deactivate control relays 19. The type of

control applied is dependent upon the type of heat element used. The location of the heat element 18 is normally at the bottom of the cavity 17. However, it can be located anywhere in the cavity. A second heat element (not shown) may also be placed at the top of the cavity 17 for broiling.

Referring now to FIGs 11-13 there is shown a combination appliance 1100. The combination appliance 1100 comprises a door 1102 which covers a cavity 17 that is used as a cooking chamber. A window 1104 enables a user to view the contents of the cooking chamber. The appliance 1100 further comprises vertical walls 1108, a top surface 1110 and a control panel 1116 mounted on the top surface. Burners 1112 are also mounted on top surface 1110. The burners 1112 may be gas, electrical, or other heating means well known in the art.

The control panel 1116 is used for obtaining input for operating the cooking chamber. Mounted on the control panel 1116 are control knobs 1114 which are used to control the burners. A display 1118 is mounted on the control panel 1116 and is used as a local control for the cooking chamber. The display would ordinarily comprise selectors 1120, which commonly are either pushbuttons or touchscreen, and/or a dial selector 1122 which may be used for selecting a temperature for the cooking chamber or scrolling through menu choices.

Within the cavity 17 is the heat element 18, an outlet 1134 duct and an inlet duct 1136. The heat element 18 may be gas, electric, or any other heat source. As shown in FIG. 13, the heating element is at the bottom of the cavity 17. However, heat element 18 may be located anywhere in the cavity 17. It is further contemplated that a second heat element (not shown) may be mounted at the top of the cavity 17 for broiling. As indicated by arrow 1132, heat rises from heat element 18.

Drawer 1106 is adapted to slide in and out to provide access to the refrigeration chamber 1160 containing the refrigeration module 11, mounted on the bottom 1124 of the drawer 1106. Referring to FIG. 14 with continued reference to FIGS 11 - 13, the refrigeration module 11 performs a refrigeration cycle to withdraw heat from cooking chamber so that the temperature in cavity 17 will be lower than the ambient temperature surrounding the appliance 1100. The Refrigeration module 11 is a closed-loop system that uses a fluid, or refrigerant, to

move heat from one place to another. Drawer 1106 is aligned such that when it is in a closed position, the ducts connecting inlet duct 1136 and outlet 1134 duct are aligned with the warm air inlet 1152 and cool air outlet 1158 of the thermally insulated evaporator housing 1128.

The refrigeration module 11 comprises a compressor 1126, condenser 1144, an expansion valve 1146 and an evaporator 1142 within a thermally insulated housing 1128. Tubing 1130 is used to connect the compressor 1126 to the condenser 1144, the condenser 1144 to the expansion valve 1146, the expansion valve 1146 to the evaporator 1142, and the evaporator 1142 to the compressor 1126 and provides the path for the fluid, or refrigerant. Arrows 1148 indicate the direction of the fluid, or refrigerant, flow through the tubing 1130.

In operation, cool, liquid refrigerant enters the evaporator 1142. The refrigerant in evaporator 1142 absorbs heat from cavity 17 communicated from inlet duct 1136 to warm air inlet 1152 and changes state from a liquid to a vapor. The vapor refrigerant exits evaporator 1142 and moves into compressor 1126. Compressor 1126 raises the pressure and temperature of the refrigerant so that the refrigerant will move through refrigeration module 11. The increase in pressure causes the refrigerant to flow out of compressor 1126 and into condenser 1144. Condenser 1144 releases heat from the refrigerant to the outside air. Refrigeration module 11 may include a condenser fan 16 (FIG. 1) for facilitating the movement of heat away from condenser 1144. The vapor refrigerant exits from condenser 1144 and goes to the expansion valve 1146. At expansion valve 1146, the pressure of the refrigerant is reduced and the refrigerant is cooled to the point where it returns to a liquid state. The cool, liquid refrigerant exits expansion valve 1146 and re-enters evaporator 1142. Upon entering evaporator 1142, the liquid refrigerant absorbs heat from warm air 1150 drawn into evaporator 1142 through warm air inlet 1152. As warm air 1150 passes over evaporator 1142, it gives up some of its heat to produce cool air 1156 which is re-circulated by evaporator fan 16 (FIG. 1) transiting a cool air duct 1170 through the cool air outlet 1158 and back into the cavity 17.

In one embodiment, the warm air inlet 1152 and the cool air outlet 1158 extend through the bottom wall of the cavity 17. An airflow inlet gate 1160 removably blocks the cool air outlet 1158 (discussed below). Likewise, an airflow outlet gate 1162 removably

blocks the warm air inlet 1152 (discussed below). It will be appreciated by those skilled in the art that the warm air inlet 1152 and the cool air outlet 1158 need not be situated on the bottom of the appliance 1100, but may be situated at any location on the appliance 1100, in accordance with the positioning of the refrigeration module 11.

In addition, the airflow inlet and outlet gates 1160 and 1162, respectively, are actuated to an open position to unblock the cool air outlet 1158 and the warm air inlet 1152. Thus, cool air, represented by an arrow 1156 and produced by a refrigeration unit located outside of the cavity 17, is delivered through the cool air outlet 1158 into the cavity 17 and warm air, represented by an arrow 1150, is drawn out of the cavity 17 through the warm air inlet 1152.

Conversely, when the appliance 1100 is in heating mode, the airflow inlet and outlet gates 1160 and 1162, respectively, are actuated to a closed position to block the cool air outlet 1158 and warm air inlet 1152, respectively. Heat, represented by an arrow 1132, is then produced by the heat element 18 to heat the cavity 17.

A first solenoid element 1164 and a second solenoid element 1166 are mounted below the cavity 17. The first solenoid element 1164 couples to the airflow inlet gate 1160 to move the gate 1160 between open and closed positions. Likewise, the second solenoid element 1166 couples to the airflow outlet gate 1162 to move the gate 1162 between open and closed positions.

Referring to FIG. 15, with continued references to FIGS. 11-14, there is shown perspective view of a gate assembly 1500 of a combination appliance 1100. The gate assembly 1500 includes the airflow inlet gate 1160, the first solenoid element 1164, and an armature 1168 coupling the airflow inlet gate 1160 to the movable iron core of the first solenoid element 1164. The gate assembly 1500 is configured to mount below the bottom wall of the cavity 17 so that the airflow inlet gate 1160 removably blocks the cool air outlet 1158 extending through the bottom wall. That is, when the first solenoid element 1164 is energized, current passes through a coil surrounding the iron core. The iron core is pulled into the center of the coil, or winding, of the solenoid in response to the current. As the iron core is pulled into the center of the winding, the armature 1168 and consequently, the airflow inlet gate 1160

move to an open position to unblock the cool air outlet 1158 extending through the bottom wall.

When the first solenoid element 1164 is de-energized, a spring (not shown) pulls the movable core away from the center of the winding. As a result, the armature 1168 and the airflow inlet gate 1160 move to a closed position to block the cool air outlet 1158. The first solenoid element 1164 is energized when cooling of the appliance 1100 is desired to allow passage of cool air 1156 into the cavity 17. Additionally, the first solenoid element 1164 is de-energized when cooling of the appliance 1100 is not desired.

Although the gate assembly 1500 is described in terms of the airflow inlet gate 1160 and the first solenoid element 1164, it should be understood, that the appliance 1100 includes another gate assembly to selectively block and unblock the warm air inlet 1152.

Those skilled in the art will recognize that other devices may be employed to actuate movement of the airflow inlet and outlet gates 1160 and 1162, respectively. For example, small motor assemblies may be used. Alternatively, a single solenoid or single motor with a dual connection point armature may be used that couples to both the inlet and outlet gates 1160 and 1162 and moves them concurrently.

Referring now to FIG. 1, the digital controller unit 20 comprises the following items: computer 21 with microprocessor with random access memory and read only memory for control program storage and operation, visual alpha/numeric display 22, and data/control entry keyboard 23. Also included is the communications interface circuits 25. It is understood that the communication interface is any suitable communication interface known in the art. Examples include but are not limited to power line communication protocols, Ethernet, and wireless interfaces.

In operation, the computer 21 executes a control program stored in electronic memory and by using input/output signals which enable the multiple functions of the digital controller unit 20. These functions are 1) receiving operating commands and data from the data/control entry keyboard; 2) displaying cooking times and related information and providing visual operator feedback for keyboard data entries; 3) monitoring safety interlock switches such as

the door as well as temperature sensors; 4) control signals to power control relays which in turn actuates the refrigeration module 11 or the heat element 18; 5) manage internal clock and timing functions as required; 6) responding to control requests submitted via digital control from remote locations.

The alpha/numeric display 22 informs the user of important information such as cooking time, operating mode and visual operator feedback of keyboard keys pressed.

Provision has also been included for the complex DISPLAY from the front of the refrigerated oven. This includes a remote display interface circuit board, which interfaces with the Display of the oven directly and relays the display contents at any point in time to the internal communication interface controller. The communication interface controller requests the display contents up to 10 times a second. The communication interface controller then packages up the display sequences and sends it out through the communication interface. The appliance server running on the home computer receives the display sequence through the communication interface operably coupled to the home computer and upon request relays this information on to the current programs running on the home computer or at the office.

The keyboard data control entry 23 is an array of electronic switches located at the front of the digital controlling unit. The switches are interfaced with the computer and provide the user a method of entering data and commands to the computer. Each switch enters specific information such as numeric values zero through nine; direct commands start/stop, etc.; automated macro commands designed to reduce user time and involvement (i.e., potato sets cooking time appropriate for cooking a potato, initiates the cooking process and stops the operation after the specified time). The front panel provides legend labels which denote the purpose of each keyboard button. This is typical of a state of the art oven.

The DC power supply 24 receives AC power from the electrical power distribution and produces all DC voltage and current required to operate the digital controlling unit. The communication interface 25 provides communication with remote control of four functional categories: temperature control, electrical power control, safety interlocks and remote control. An electronic temperature sensor (not shown) located in the cold air path is electronically

interfaced to the computer. This allows the computer control algorithm stored in memory to measure the refrigerator temperature if the measured temperature is above an established set point or correction signal is sent to a control relay that energizes the refrigeration system. This is mutually exclusive of cooking activities of course.

The electronic power control at the communication interface 25 is provided to allow low voltage, low power logic signals from the personal computer 26 to energize or de-energize control relays that activate the cooking system or refrigeration system.

The software involved consists of three major parts. The first part is the appliance server which directly controls all of the appliances in a home. This is accomplished using the communication interface protocol which is generally found in home networks. The second part of the software portion of Applicant's invention is a Graphical User Interface (GUI) for easily controlling home appliances as well as managing the meals that are to be cooked. The third part of the software allows homeowners to control and monitor their appliances while away from the home through the GUI or from their favorite worldwide web browser. Many homes and small offices are being equipped with "Thin Servers". These so called "Thin-Servers" are appliance-like devices that control home computer/print networks, Internet connections, home lighting and intelligent appliances. The home computer or "Thin-Server" can be used to monitor and control the home appliances, including microwaves, ovens and refrigerators, as well as other appliances. The protocol used to control such an appliance from the home server is one that has been developed specifically for the home network communication interface. The communication interface protocol allows one to provide an abstract definition of say an appliance and be able to query it and perform operations on it. Communication interface can operate over many different types of networks, power lines, radio frequency, coaxial cable and twisted pair, as well as others. The Applicant's invention uses existing power lines in an existing home to communicate to the appliances. This avoids retrofitting a home with a new network. Applicant's invention uses object oriented methodologies in many ways. The system is written in an object oriented language. Second, the communication interface protocol is object oriented by design. Each communication

interface device is considered an object with attributes that can be interrogated or changed directly via operations or methods. Lastly, the technology used to communicate with the home appliances from anywhere in the world is a remote interface means for selective control and monitoring of appliance via a remote disposed data terminal. The remote interface is any suitable remote interface known in the art. Essentially, this technology allows one to easily design objects (such as home appliances) in one's home. These objects can be directly manipulated from any computer around the world.

The use of the remote interface is an important aspect for the remote operation of the appliance. A remote interface object on the home server is built for each home appliance. These objects take requests from the software to control the appliance. The software could be located locally on the home server or could be remotely located at one's office in another state or country. This allows a homeowner to remotely monitor their home with unprecedented ease and ability. One can also use any worldwide web browser, including, but not limited to Microsoft Internet Explorer and Netscape Navigator/Communicator, to monitor or control a home appliance. This is accomplished by using a version of Applicant's software which is written as a Java applet. This applet is launched within the browser and provides the means to communicate with remote interface objects on one's home server that controls the home appliances. The home appliances are controlled via software running on the home server. The home server must be able to communicate using the communication interface protocol via some network media. The communication media interface for communicating information between the oven and the home server is used. The communication media is any suitable communication medium known in the art, such as powerline, Ethernet, and wireless communication. The software on the home server that controls the home appliance is called the appliance server. This is a program that among other things understands communication interface. When started, the appliance server searches for all home appliances in the home. It does this by broadcasting a communication interface request on the communication media to which all communication interface compliant home appliances respond. Response includes its address on the network, the type, manufacturer and model of the appliances. The appliance

server knows, based on the appliances manufacturer and model, how to control the appliance. After discovering all home appliances in the home, the appliance server then creates a remote interface object for each appliance. If the home appliances are powered on after the appliance server has started, the appliance broadcasts an announcement that is received by the appliance server. The appliance is then made available via a remote interface object.

The preferred remote interface is as follows.

SetClock (Integer Hours, Integer Minutes)

GetStatus (Integer Status)

StartCooling ()

StopCooling ()

SetCookTime (Integer Hours, Integer Minutes, Integer Seconds)

SetTemperatureLevel (Integer Temp)

GetTemperatureLevel (Integer Temp)

Cancel ()

Start ()

ReadDisplay (String DisplayStr)

SetSafeTemperatureLevel (Integer Temp)

This is the basic interface required to control any home appliance. Other interfaces can be provided based upon the type, manufacturer and model of a specific home appliance.

The remote interface objects representing home appliances wait for requests. Applicant's software GUI and Applicant's Java applet are two programs that communicate with the remote interface objects in order to control the appliances. These programs are referred to as remote interface clients. Once the client programs connect to these objects, they operate on them as if they were locally defined and created within the client program. The client programs can then use the object's interface to manage the remote appliance.

As far as safety is concerned, the remote interface object provides an interface for specifying a safe temperature level. If the temperature of the unit rises above this level, the remote interface object will tell the home appliance to shut down. The object will also notify

all client programs that are connected to it that a high temperature condition has occurred. An object can also notify all connected clients if a home appliance has stopped responding to input.

The core of software system is the management/GUI software that allows the user to view each home appliance being controlled. Each appliance can be programmed to keep a dish cool until it is time to be cooked. Dishes can be defined by the user which spells out the steps to cook the dish and whether or not it needs to be kept cool before cooking.

A major feature of software is the ability to monitor and manage home appliances from remote locations. Applicant's software accomplishes this by providing an appliance server software that runs on the home server. This software is a remote interface server that spawns a remote interface appliance object for each home appliance that it discovers on the home network. These appliance objects continually monitor the real home appliance as well as wait for the GUI software to connect to it. The Applicant's software that connects the appliance objects is referred to as client software. The client software can be run at home on the home server or on another machine in the home. Remote interface objects are inherently distributed. This means that not only can any computer in the home manage home appliances through the remote interface appliance objects, but from any computer in the world, one can monitor and manage appliances in their home. The client software described earlier communicates with appliance objects residing on the home server. The client software is configured with the Internet address of the home server. This allows it to remotely communicate with the home server through the Internet. The client software communicates with the appliance objects through a well known port number. The client software transparently makes requests to the home objects which passes the requests along to the real appliance.

It is not necessary to have the menu management software installed in order to remotely monitor and manage home appliances in one's home. All it takes is a worldwide web browser, including but not limited to Microsoft Internet Explorer and Netscape Navigator/Communicator. The Applicant's software is also available in the form of a Java applet that can be run from the browser. Having the software available from a browser, users

can use just about any type of computer operating system to remotely connect to their home and control home appliances. This gives people unprecedented access and control over their home while away.

Referring to FIG. 2, a block diagram representation of the overall software included in the invention. Two major components of the software used by the invention are shown in FIG. 2. The first software component runs on the home computer and has been titled Tonight's Menu Appliance Server Software 100. The Tonight's Menu Appliance Server Software 100 can be attached to a communication media 150 via a variety of computer industry communication protocols. The present invention discloses a communication interface Subsystem protocol 120 to communicate with the home appliances 200. The Tonight's Menu Appliance Server Software 100 receives information from the internet and translates this information into specific commands to operate the home appliances 200.

After the Tonight's Menu Appliance Server Software 100 is started, it will initialize the communication interface Subsystem 120 and identify the various home appliances 200 that are connected to the communication media 150 and enable communication with the communication interface Subsystem 120. The Tonight's Menu Appliance Server Software 100 will also create a remote interface appliance object 110 for each home appliance 200 that can communicate with the communication interface Subsystem 120. The remote interface appliance objects 110 will allow the Tonight's Menu Client Software or Browser Software 50 to locate the remote interface appliance objects 110 through the Internet and communicate with the Tonight's Menu Appliance Server Software 100.

Thus, a user on a remote computer running the Tonight's Menu Client Software 50 connected through the Internet through the remote interface appliance objects 110 to the Tonight's Menu Appliance Server Software 100 can communicate and operate home appliances 200.

Referring to FIG. 3, the Tonight's Menu Appliance Server Software 100 is brought on line in phases. First, all the Appliances 100 to be connected to the system have to be turned on. Second, the Tonight's Menu Appliance Server Software 100 has to be started. After the

Tonight's Menu Appliance Server Software 100 is started, it will initialize the remote interface Subsystem 115 which broadcasts out on the communication media 150 (FIG. 2) it's address on the network. The communication interface Subsystem 120 (FIG. 2) acts as a network where every appliance 200 (FIG. 2) is identified by an address that is available to anyone accessing the communication interface Subsystem 120.

The Tonight's Menu Appliance Server Software 100 will create a remote interface appliance manager object 125 which provides a well known object for managing the set of discovered appliances. The Tonight's Menu Appliance Server Software 100 will also create a remote interface food dish manager object 140 that provides a well known object for management of defined food dishes.

The user configures and selects what appliances 200 will be used to prepare the food dishes for the day. Once the user has selected the appliances 200, a list of those appliances 200 will be contained in a initialization file. The Tonight's Menu Appliance Server Software 100 will retrieve the list of configured appliances 155 and communicate with the configured appliances 200 to ascertain what type of appliance it is, whether a microwave or conventional oven, what model, what are its capabilities, etc. After this information has been obtained, the Tonight's Menu Appliance Server Software 100 will initialize the communication interface device on board each appliance 175 and create a remote interface appliance object for all the appliances 180. The Tonight's Menu Appliance Server Software 100 initialization routines form the framework for communicating with the Tonight's Menu Client Software 50.

Referring to FIG. 4, the Tonight's Menu Appliance Software 50 contains the procedures for communicating with the Tonight's Menu Appliance Server Software 100 in diagramatic fashion. In the figure, the procedure is commenced with a remote interface subsystem initialization routine 51. The remote interface Subsystem initialization routine 51 initializes an object management system, which allows the user to communicate between the Remote Appliance Object 45 and the remote interface appliance objects 110 located on the user's home computer.

The remote interface Subsystem Initialization Routine 51 will contact the remote

interface Appliance Manager 52 on the Tonight's Menu Appliance Server Software 100 and obtain information regarding the various Appliances 200 connected to the Tonight's Menu Appliance Server Software 100. Once the remote interface Subsystem Initialization Routine 51 has obtained a list of Appliances 200 connected to the Tonight's Menu Appliance Server Software 100, the Tonight's Menu Client Software 50 Remote Appliance Objects 45 will bind to the Tonight's Menu Appliance Server Software's 100 remote interface Appliance Manager Object 53.

In addition, the remote interface Subsystem Initialization Routine 51 will also contact the remote interface Dish Manager 54 on the Tonight's Menu Appliance Server Software 100 and obtain information regarding the various food dishes to be prepared. After the remote interface Subsystem Initialization Routine 51 has received the information regarding the food dishes, the Tonight's Menu Client Software's 50 will bind to the Tonight's Menu Appliance Server Software's 100 remote interface Dish Manager Object 55. Upon completion of the binding process, the Tonight's Menu Client Software 50 will allow the user to Open An Appliance 300, Manage An Appliance 400 or Manage Dishes 500.

Looking to FIG. 5, the Opening An Appliance Software 300 allows the user to access an Appliance 200 using Applicant's invention. The user will select the open appliance option from the file menu 310. This will indicate to the Tonight's Menu Client Software 50 that the user wants to view or act upon a particular appliance 200 that is managed by the Tonight's Menu Appliance Server Software 100. At Block 320, the Tonight's Menu Client Software 50 communicates with the Tonight's Menu Appliance Server Software 100 located on the home computer through the appliance manager remote interface object. A list of defined appliances 200 is retrieved from the appliance manager. This list is used to display a list of available appliances 330.

When the user has selected an appliance to open, a user interface window is created 340. This window will graphically represent the microwave or conventional oven that is being controlled. This includes the portrayal of keypad buttons as well as an Display of the appliance 200. The selected remote interface object is then associated with the window representing the

appliance 350. Finally, the window is displayed in the Tonight's Menu Client Software 50. This function also includes automatically updating the Display without the users need to interact.

FIG. 6 illustrates the various options a user can exercise regarding the management of appliances software 400 that is specified in block 410 to 470. The list of appliances and the information about the appliances 200 is stored on the home computer. The Management of Appliances Software 400 allows the user to modify and maintain the information regarding the appliances 200 remotely. Block 410 shows the Management of Appliances Software 400 interrogating the remote interface Appliance Manager on the Tonight's Menu Appliance Server Software 100 for the list of appliances. After the remote interface Appliance Manager receives the list of all the remote interface appliance objects 110, it will present the list in a list box and the user will have several options available. The options the user will have available pertaining to the list box includes being able to add an appliance 430, modify an appliance 450 and delete an appliance 460.

An appliance is added by sending a message to the remote interface Appliance Manager 52 requesting to add an appliance 430. This message is a function call on the appliance and on the remote interface Appliance Manager 52. The Tonight's Menu Appliance Server Software 100 will create a remote interface Object and make it available for communication. Once that is complete, an empty remote interface Appliance Object 435 will be created and a dialogue box will appear on the Tonight's Menu Client Software 50 and prompt the user for new information regarding the capabilities of the appliance 440. After the user enters the appliance information including the appliance's communication interface address on the home computer, this information is transmitted to the home computer and stored in the initialization file which will be retrieved the next time the Tonight's Menu Appliance Serve Software 100 is started.

The Modified Appliance 450 and the Delete Appliance 460 activities are contained in Blocks 430 through 470. Block 450 shows where the decision is made whether to modify the appliance 200, if the decision is yes, the user is prompted for new information regarding the

appliance 440. If the user makes the decision to delete an appliance 460, the remote interface Appliance Object is removed 470.

FIG. 7, discloses the management of dishes software 500 flow chart which details the steps necessary for an appliance 200 to prepare a food dish. The dish manager remote interface object 510 is located on the home computer in order to centralize the management of the food dishes. The management of dishes software 500 allows the user to add a food dish 530, modify food dishes 550, modify cooking steps 570 or delete food dishes 580.

Once the user is presented with a list of food dishes 520, the user can choose to add a dish 530 and the program will create an empty remote interface dish object 540. The software will prompt the user for new values of dish properties or cooking information 560. This information would include a description of the food dish, comments regarding the food dish, list of cooking steps and whether the food dish should be kept cool prior to cooking. If the user selects the modify dish option 550, the user will again be prompted for new values of dish properties 560. At this point, the user can modify a variety of information regarding the food dish including the description of the food dish or the cooking steps.

Blocks 605 through 630 illustrate how to add a cooking step, modify a cooking step or delete a cooking step. A cooking step includes the cooking duration, the cooking time in hours, minutes and seconds, cooking temperature for conventional ovens and cooking levels for microwaves. If the user chooses to add a cooking step, the software will add a cooking step 605 after it presents the user with a list of the present cooking steps 600. The software will create an empty remote interface step object 610 and prompt the user for new values of step properties 615. The user will also be prompted for new values of step properties 615, if the user selects the modify step 620 option. Furthermore, a cooking step can also be deleted 625 by removing the pertinent remote interface step object 630.

Referring to FIG. 8, the flow chart illustrates utilization of the Tonight's Menu Client Software 50 in combination with the Tonight's Menu Appliance Server Software 100 to operate a home appliance 200 from a remote location. After the user has executed the Opening an Appliance software 300, the user can press a button on the remotely located user interface

for the particular appliance 820 to be used. The software will analyze and determine the button code 830 and invoke the button press method on a remote appliance remote interface object 840. Information regarding a particular button that was pressed by the user will be transmitted from the Tonight's Menu Client Software 50 to the Tonight's Menu Appliance Server Software 100.

Once the Tonight's Menu Appliance Server Software 100 receives this information, the receive button code from remote interface object 850 will begin processing this data. The button information will be checked to ascertain whether it is a valid code 860, and if not, an error message 870 will be sent to the user. If the button information is a valid code, the data will be translated into the appropriate communication interface packet and transmitted to the specific appliance 880 to be used. The Tonight's Menu Appliance Server Software 100 will notify the user that it has successfully received the user's remote button command.

FIG. 9 provides a flow chart describing how a user would program an appliance to prepare a food dish from a remote location 900. Blocks 905 through 925 illustrate how the user would be presented with a list of dishes 905 to facilitate the selection of a dish to be cooked and be prompted to supply the software with a specific time when the food dish is to be ready 910. Once the Tonight's Menu Client Software 50 has received the proposed finished times for the food dish 910, the software will determine the appropriate start time 915. The software will calculate whether the time required to prepare the meal is sufficient in order to complete the meal by the finish time selected by the user 920. If there is insufficient time to prepare the dish before the finish time, the software will loop back and request the user to re-enter another dish finish time. However, if there is enough time to cook the dish 920, the food dish information will be sent to the appliance server via the remote interface appliance server 925.

The Tonight's Menu Appliance Server Software 100 will receive the food dish information via a remote interface appliance object 930. After the Tonight's Menu Appliance Server Software 100 has received the dish information, the Tonight's Menu Appliance Server Software 100, also performs a check to determine whether there is enough time to cook the

dish 935. If there is not sufficient time to cook the dish before the dish finish time, the Tonight's Menu Appliance Server Software 100 will return an error code to the user. If there is sufficient time to cook the dish, the Tonight's Menu Appliance Server Software 100 will start cooling the dish in the appliance 945. The software will then determine the appropriate time to start cooking the dish in order to have it completed by the desired finish time.

The Tonight's Menu Appliance Server Software 100 will periodically check whether it is time to start cooking the dish 950. If it is time to start cooking the dish, the Tonight's Menu Appliance Server Software 100 will send the appropriate button press sequences to execute the predetermined cooking step 955. The program will determine if the software has reached the last cooking step 960. If the software has not reached the last cooking step, the program will loop back to the time to start cooking routine 950 in order to determine whether it is time to start the next cooking step. If the software has reached the last cooking step, then the software will provide the appliance 200 with instructions to keep the dish warm 970.

FIG. 10, shows the flow chart for the remotely drawing the appliance display software 1000. This flow chart illustrates how the appliance's 200 display screen is able to be reproduced for the user at a remote location. The Tonight's Menu Appliance Server Software 100 uses a remote display interface circuit board ("RDIB") that allows for a real time remote location acquisition and display of a microwave or conventional oven's display screen. The RDIB acquires and processes the display data and on demand transmits it to the communication interface adapter for eventual display at a remote location. A typical microwave or conventional oven will have a six position LED Display and there are sixteen segments in each position which the RDIB scans and captures the illuminated LED's on each of the six different positions for translation. The RDIB then translates the illuminated six different positions into a character or a number 1010.

The RDIB will buffer one (1) second worth of sequences of the display 1020 prior to translating the display information into a communication interface packet. Once the one (1) second buffer of display information is translated into a communication interface packet, this information is transmitted to the appliance server 1030. After the communication interface

packet is sent to the appliance server, the appliance server will buffer two (2) seconds of the display information 1040 prior to transmitting it to the Tonight's Menu Client Software 50. The buffering of an additional second of display information will improve the transmission process of the display information to the Tonight's Menu Client Software 50.

Once the Tonight's Menu Client Software has received the display information through the remote interface appliance objects 1050, the software will determine the number of display sequences to show 1060. The Tonight's Menu Client Software 50 will determine whether it has finished its display sequences 1070. If not, the software loops back to the receive display information through the remote interface appliance object routine 1050. If the Tonight's Menu Client Software 50 has finished with the display sequences, it will paint the display screen of the specified appliance on the user's remote interface 1080. The software will briefly delay the painting of the appliance's display information to imitate a display refresh process on an appliance 1090. Finally, the programs will loop back to the finish with display sequence 1070 in order to determine whether it has finished displaying all of the pertinent information.

It will be appreciated by one skilled in the art that the preceding description of remotely drawing the appliance display software, as shown in FIG. 10, may be accomplished in a myriad of manners. The capture of the appliance display generally pertains to the retrofitting of an existing appliance. The person skilled in the art will understand that the method described herein may be incorporated into a new appliance. For example, a remote computer accesses the new appliance over any communications channel known in the art. The remote computer then interrogates the appliance for status information and updates. Upon receiving the request for a status update, the appliance may then collect or aggregate the current status information. Having collected the information requested by the remote computer, the appliance then transmits the information to the remote computer using any suitable communications channel. Thus the remote computer is not simply capturing the display of the appliance, but rather presenting to the user status information independent of the information currently be displayed on the appliance display.

The foregoing description of a preferred embodiment of the invention has been

presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed. Obvious modifications or variations are possible in light of the above teachings. The embodiment was chosen and described to provide the best illustration of the principles of the invention and its practical application to thereby enable one of the ordinary skill in the art to utilize the invention in various embodiments and with various modifications as are suited to the particular use contemplated. All such modifications and variations are within the scope of the invention as determined by the appended claims when interpreted in accordance to the breadth to which they are fairly, legally and equitably entitled.